

(No Model.)

2 Sheets—Sheet 1.

J. B. HAMILTON.  
MAGNETIC SEPARATOR.

No. 571,362.

Patented Nov. 17, 1896.

Fig 2.

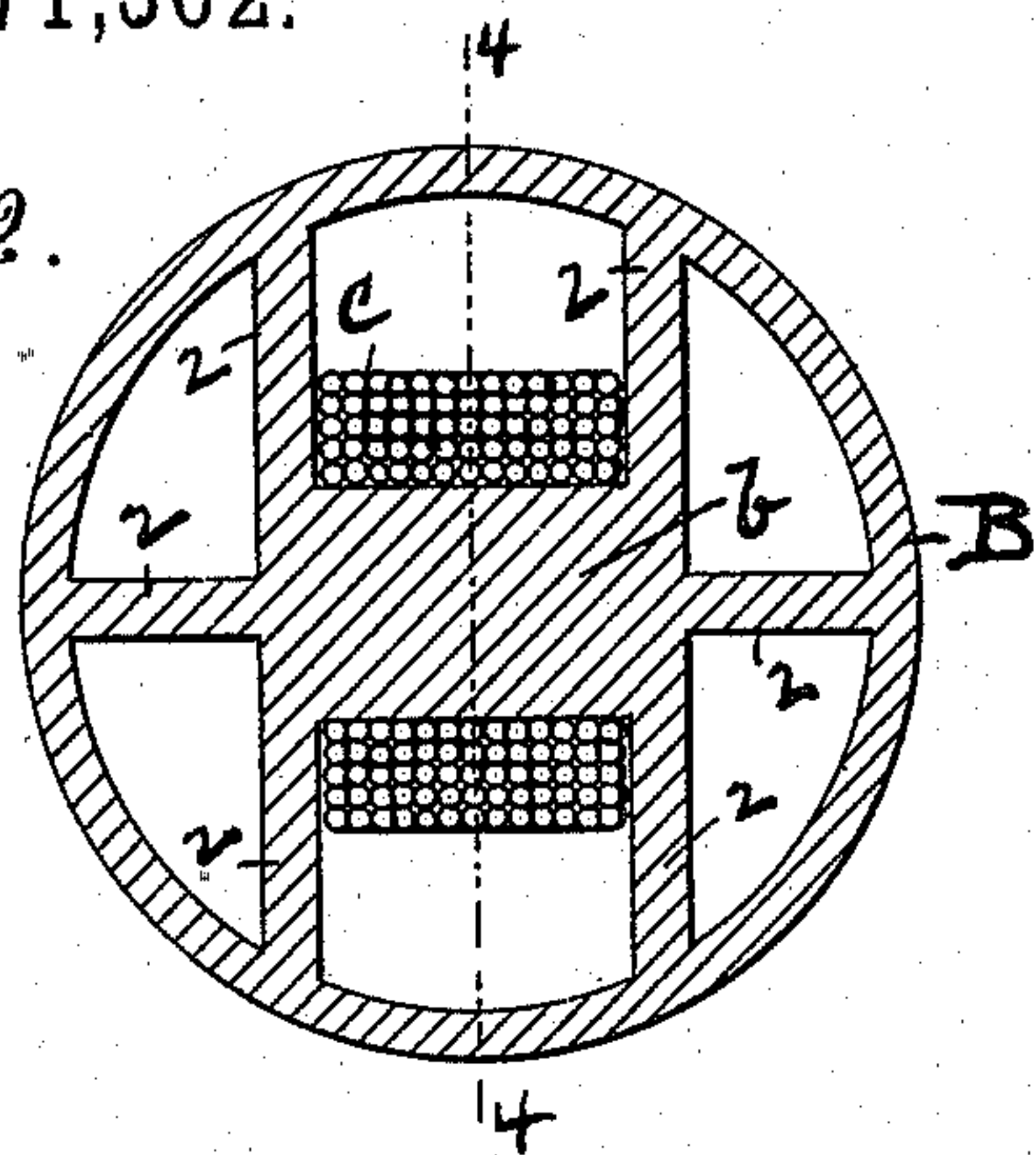


Fig 3.

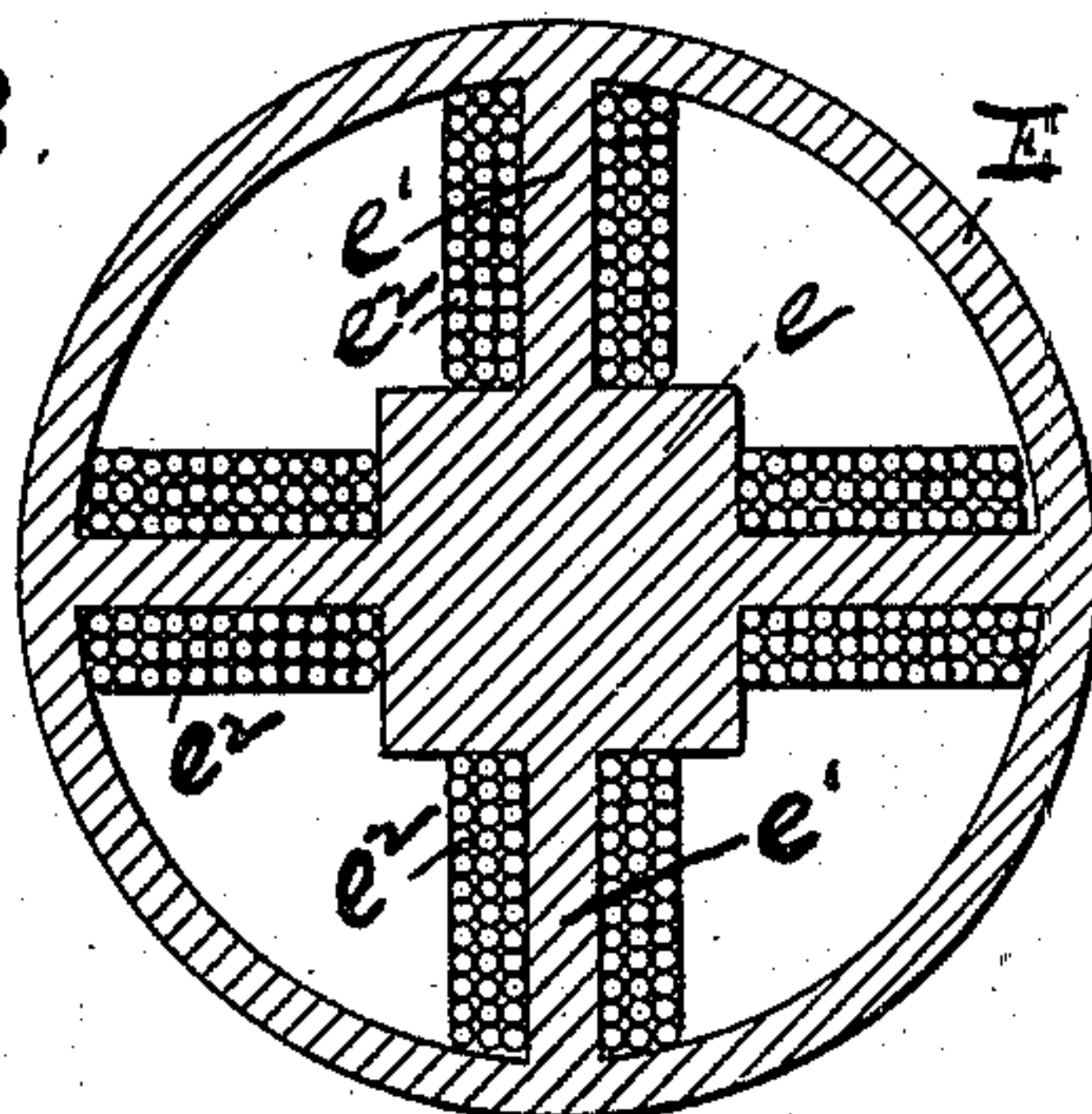
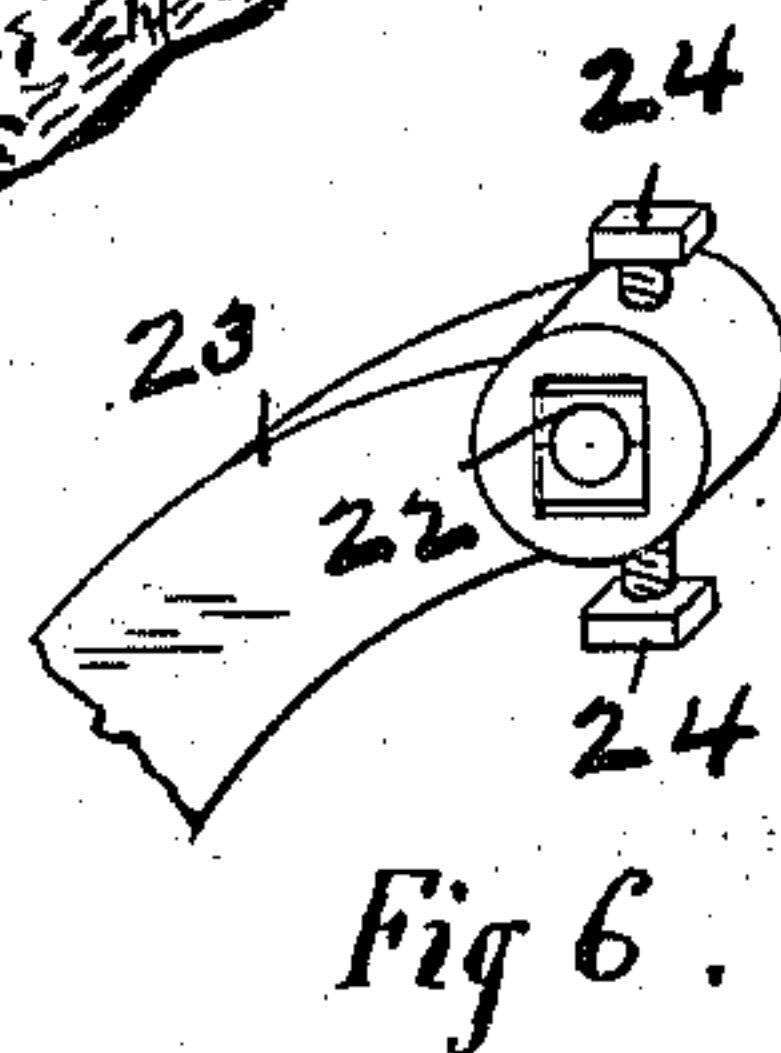
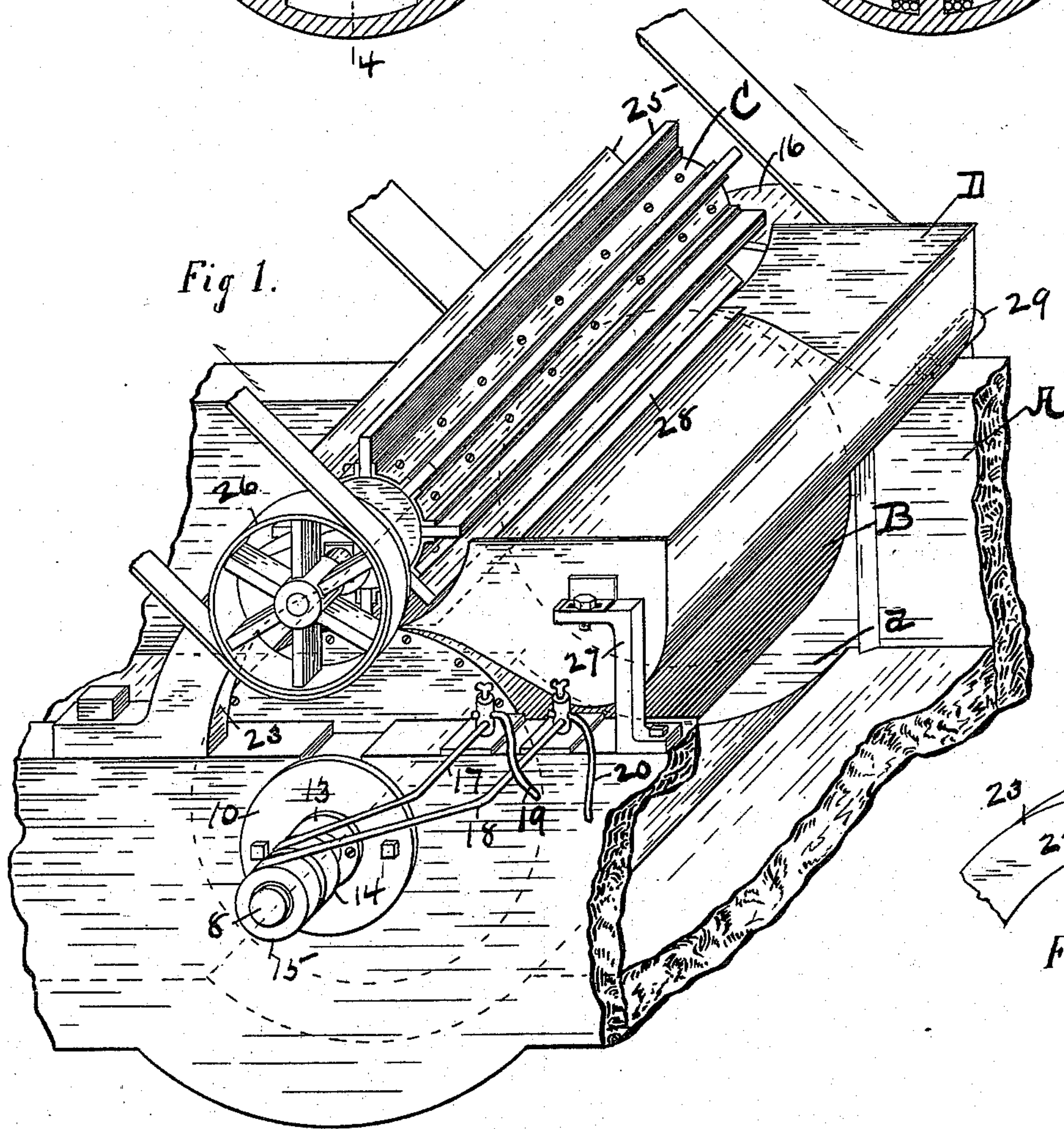


Fig 1.



Witnesses.

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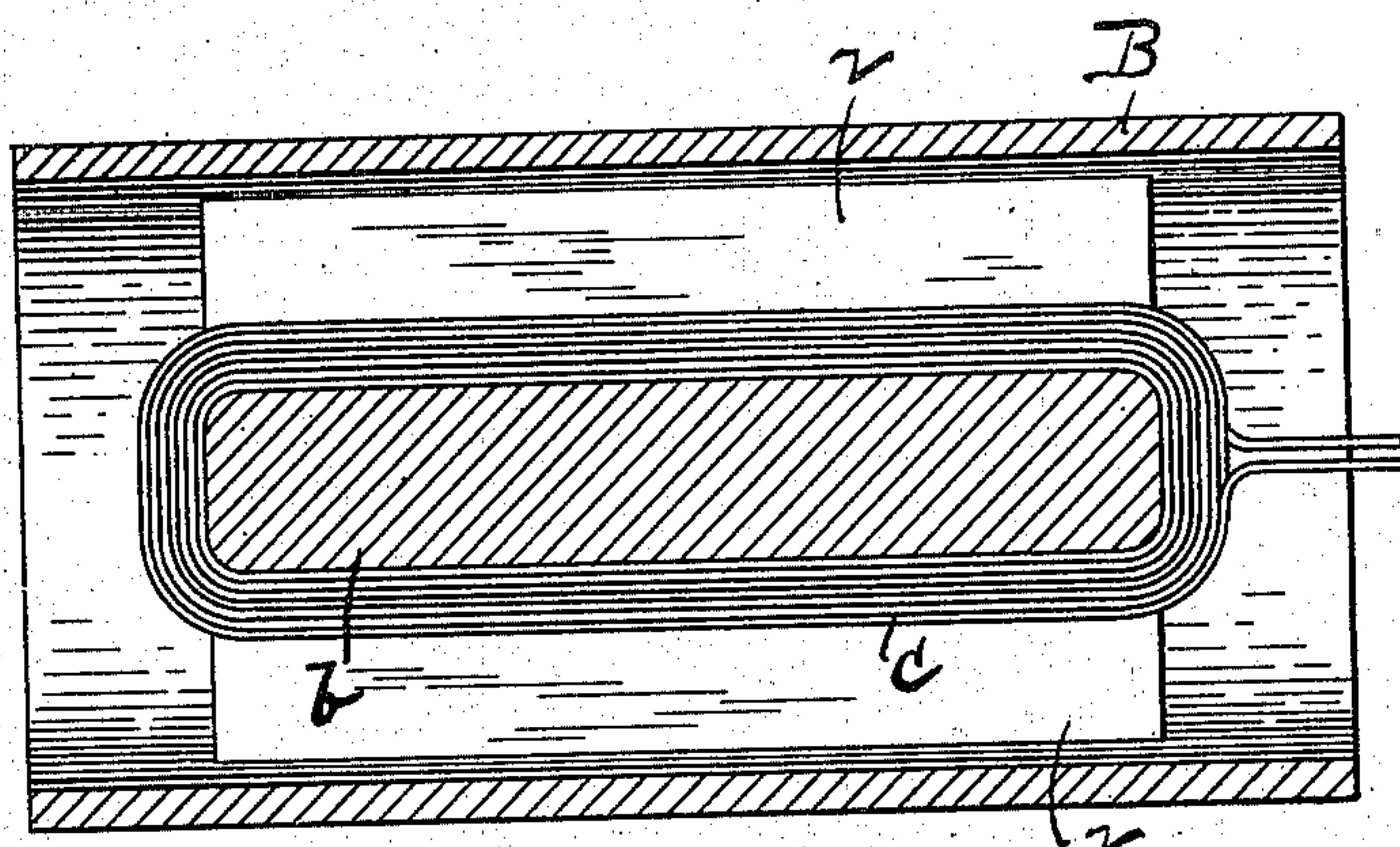


Fig 4.

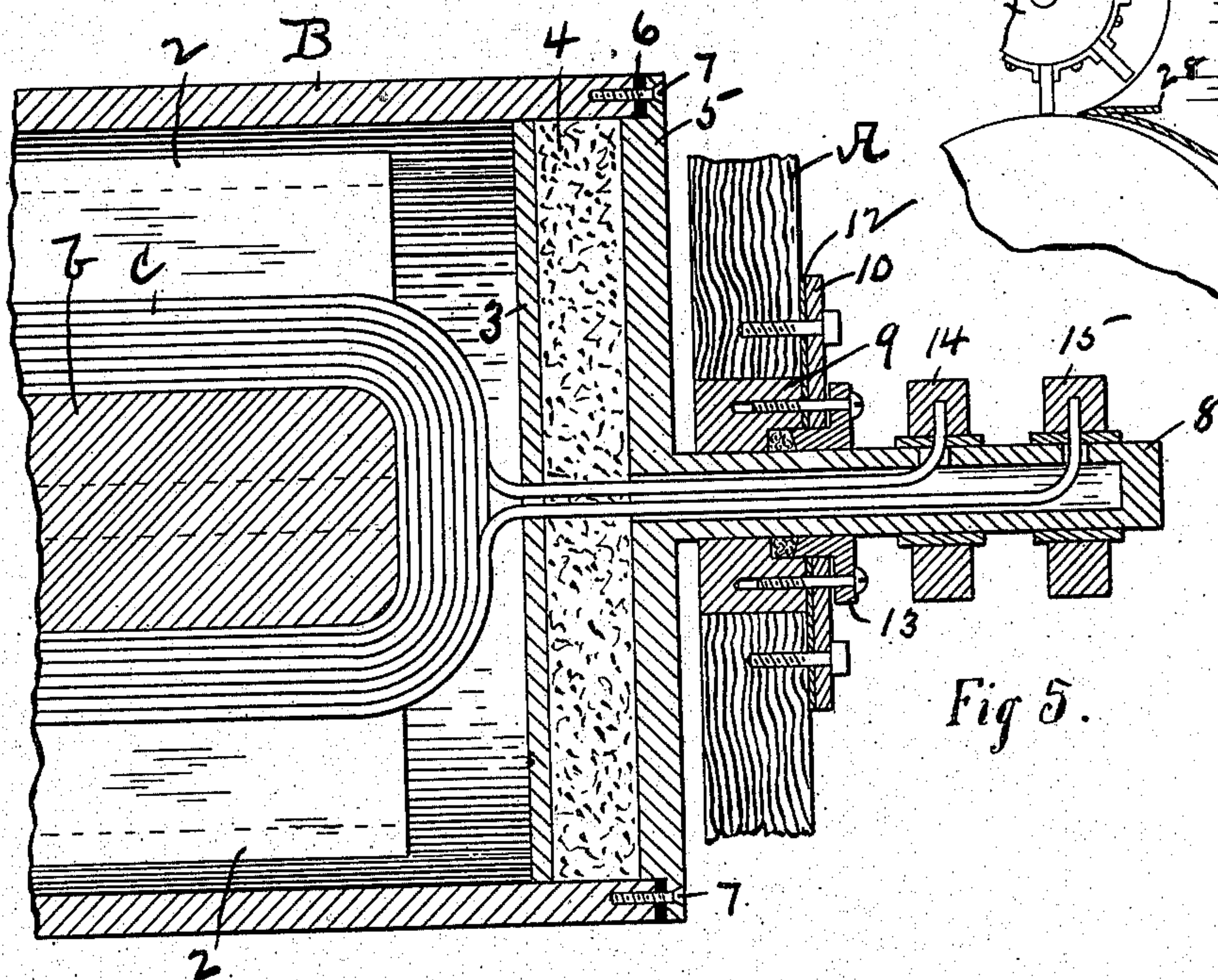


Fig 5.

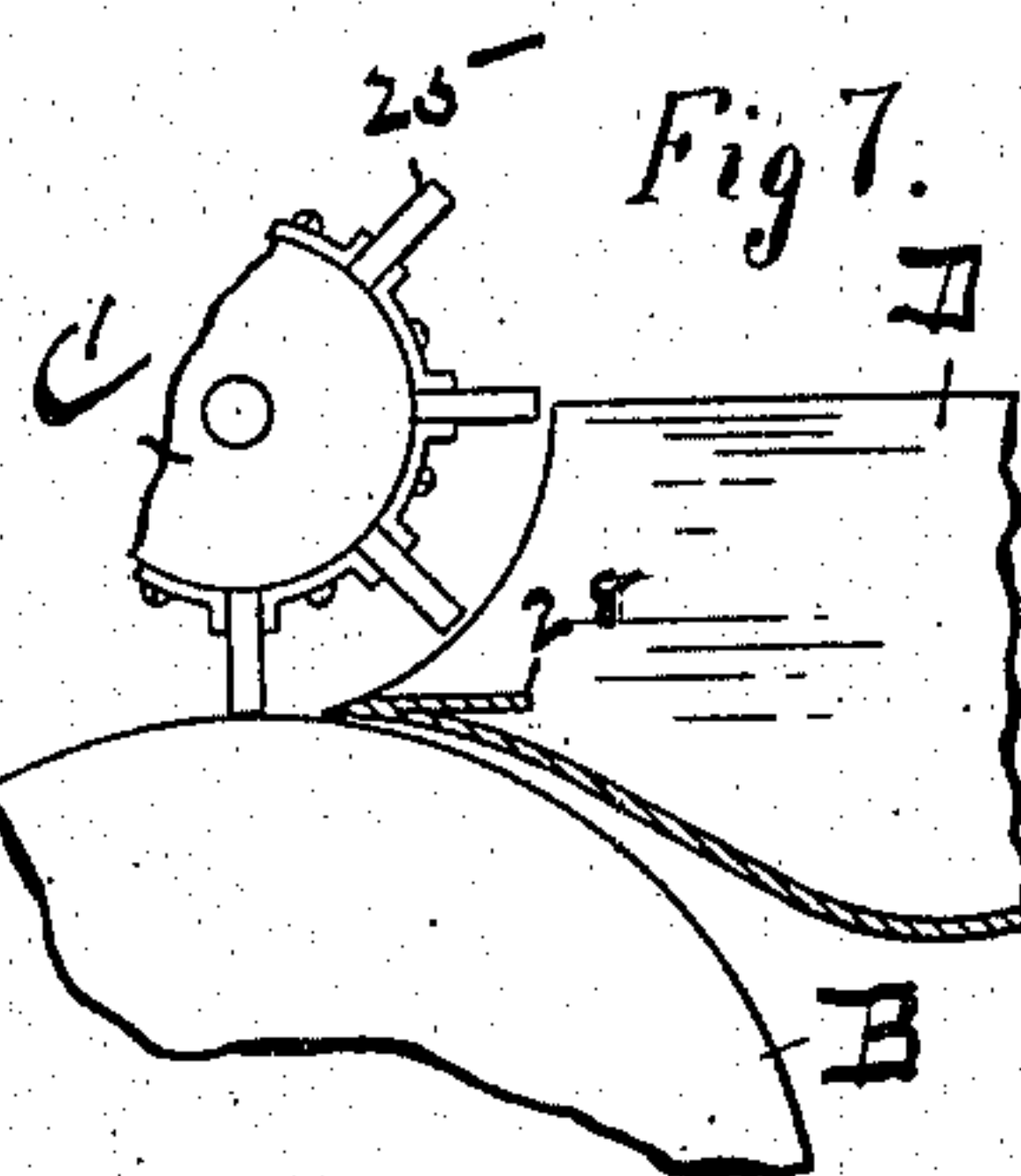


Fig 7.

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# UNITED STATES PATENT OFFICE.

JOSEPH B. HAMILTON, OF SPRINGFIELD, MASSACHUSETTS.

## MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 571,362, dated November 17, 1896.

Application filed December 5, 1893. Serial No. 492,845. (No model.)

*To all whom it may concern:*

Be it known that I, JOSEPH B. HAMILTON, a citizen of the United States, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented a new and useful Improvement in Magnetic Separators, of which the following is a specification, reference being had to the accompanying drawings, forming part thereof.

My invention relates to apparatus for eliminating particles of iron from a flowing stream of liquid or semiliquid material by means of one or more electromagnets, and it has especial reference to the elimination of iron particles from the pulp or "stuff" from which paper is made while the same is on its way to the forming wire or cylinder of the paper-machine.

The object of the invention is to provide a comparatively simple and inexpensive apparatus which will infallibly remove all of the particles of iron from the material with which it is used without obstructing or retarding to any material extent the flow of said material, and by which a very powerful magnetic attraction can be produced with a comparatively light electrical current.

To these ends my invention consists in the apparatus constructed and operating, as hereinafter fully described, and particularly pointed out in the claims.

Referring to the drawings, in which like letters and figures designate like parts in the several views, Figure 1 is a view in perspective of a portion of a pulp chute or conduit having applied thereto an apparatus embodying the invention. Fig. 2 is a cross-section of the electromagnetic cylinder. Fig. 3 is a similar view of a modified form thereof. Fig. 4 is a longitudinal section taken in the plane of line 4 4 of Fig. 2. Fig. 5 is a partial longitudinal section of the cylinder drawn to a larger scale and showing the manner of supporting it upon the chute or conduit. Fig. 6 is a detail view of one of the bearings for the wiper-shaft. Fig. 7 is a cross-section of the receiver for the particles of iron removed from the cylinder.

The letter A designates a chute or conduit for a flowing body of liquid or semiliquid material, as, for example, the ordinary "sand-trap" through which pulp is conducted on

its way to a paper-machine. The apparatus devised by me can be located at any desired point in said conduit, and it consists, primarily, of a cylinder or shell B of iron, revolvably supported at its ends in the side walls of said conduit, and having an internal core b extending longitudinally thereof, about which is wound the wire helix c, through which is passed the electric current which energizes the magnet. In the form of the invention shown in Figs. 2, 4, and 5 said core b is joined to the shell by six wings 2, which meet the shell at substantially equal distances from each other, thereby diffusing the magnetic force uniformly throughout the cylinder or shell. Said core and wings are of sufficiently less length than the cylinder proper to admit of the insertion of disks 3 of hard rubber or other suitable insulating material next to the ends of the helix, and layers of a suitable insulating compound 4, which compound is introduced within the ends of the cylinder in a plastic state and then permitted to harden. Heads 5 are then applied to the cylinder together with an interposed packing-ring 6 of soft rubber or other suitable material, and are secured thereto by screws 7 passing through the heads into the shell, all as shown in Fig. 5. By thus packing the ends of the cylinder I effectually protect the core and helix from moisture and insure their proper operation under all circumstances. Formed integral with or suitably secured to said heads 5 are trunnions 8, by which the cylinder is revolvably supported upon the side walls of chute A, and I prefer to secure such support by means of metallic blocks 9, let into recesses in said walls, through which said blocks said trunnions pass, collars 10, secured to the outer sides of said walls and overlapping said blocks, serving, together with a suitable interposed packing 12, to prevent the escape of the liquid material from the chute around the blocks. A stuffing-box collar 13, surrounding the trunnion and held in place by screws passing through the collar 10 into the block, and suitable interposed packing prevents the escape of liquid material in a like manner around the trunnions. One of said trunnions is made hollow for a portion of its length, as shown in Fig. 5, and the two ends of the wire helix c are led there-



through to contact-collars 14 15, exteriorly mounted upon the trunnion, and the trunnion at the opposite end of the cylinder carries a band-pulley 16, (see Fig. 1,) whereby motion is imparted to the cylinder. Brushes 17-18, leading from binding-posts on the chute to the collars 14 15, and wires 19 20, leading from said binding-posts to an electric generator, (not shown,) serve to conduct the electric current through the helix *c* in a manner which will be obvious to persons skilled in the art.

By causing the core and helix to extend longitudinally of the cylinder and throughout the greater portion of the length thereof, as described, I am enabled to secure a very powerful magnetic field surrounding the cylinder with a comparatively light electric current, and one which, by reason of the wings 2, is so equally diffused as to prevent the formation of neutral points, so that any particles of iron contained in the material flowing through the chute A will infallibly be drawn to and retained upon the surface of the cylinder, so long as the passage of the electric current through the helix is maintained. I am thus enabled to utilize a comparatively small dynamo with the apparatus and thereby effect a material saving in the use of power over most of the devices for this purpose now in use. With a view to increasing the period during which the material passing through the chute will be within the field of the magnet, I prefer to form a depression or channel in the bottom of the chute, which is concentric with the cylinder, as shown at *a* in Fig. 1, thereby securing such result without obstructing or impeding the flow of said material. The surface of the cylinder may be covered with copper or other non-corrodible material; but I prefer to apply thereto a coating of lacquer, such, for example, as that known to the trade by the name of "kristaline," which can be readily applied with a brush, and, when hardened, effectually protects the cylinder from corrosion and does not affect its magnetic properties.

To remove the particles of iron from the surface of the cylinder, I utilize a wiper-shaft C, supported at its ends in boxes 22, (see Fig. 6,) mounted in standards 23 on the chute and rendered vertically adjustable by screws 24, said shaft having a series of radial sockets, in which are secured the wipers, preferably composed of strips 25 of soft rubber. A band-pulley 26 at one end of said shaft enables it to be driven independently of the cylinder. Said shaft is so adjusted as to cause the outer edges of its strips 25 to make a wiping contact with the surface of the cylinder, and it is driven at a much higher rate of speed, whereby it is certain to remove all of the particles of iron from the former. Said particles as they are thus brushed from the cylinder are thrown by the wipers into a receiver D, which preferably consists of a box-like receptacle supported at its ends upon

standards 27 on the chute and having the side thereof facing the cylinder and wiper-shaft open and its bottom extended to a point between said cylinder and shaft, as shown more clearly in Fig. 7. At its outer edge said extended bottom terminates in an inturned lip or flange 28, and the iron particles thrown into said receiver, which might otherwise be again magnetically attracted to the surface of the cylinder, are caught by said lip and prevented from engaging the cylinder. At one end thereof the receiver D is provided with an outlet-opening near its bottom and with a pipe 29 leading from said opening beyond the wall of the chute to permit the escape of the liquid material thrown into the receiver by the wipers and the particles of iron commingled therewith. The receiver is preferably secured to the standards 27 by means of slotted ears and bolts, as represented in Fig. 1, to enable the same to be adjusted toward and away from the cylinder and wipers and insure the proper position of its projecting bottom relatively to said parts under all circumstances.

In Fig. 3 I have shown a modified form of the magnetic cylinder, in which the letter E designates the cylinder or shell and *e* its core. The core in this instance has but four wings *e'* joining it to the shell, and about each of said wings is wound a helix *e''* said helices extending longitudinally of the cylinder in the same manner as the one first described. The electric current can be conducted through each of said helices independently or through the four helices successively, as may be desired, a very powerful magnetic field being created about the surface of the cylinder in either case; but I prefer to use the single helix first described, as being less expensive and producing a sufficiently powerful magnetic action for the purpose described.

Instead of making the cylinder and its core in one piece as herein shown it is obvious that the core and its wings could be independently produced and inserted and secured within the shell, if desired, without affecting the action herein set forth.

The magnetic separator herein described is simple and inexpensive in construction, entirely automatic in its cleaning action, and not liable to get out of working order. By its use the waste of paper owing to the presence therein of particles of iron and iron rust can be entirely obviated.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a magnetic separator, the combination with a revolving electromagnetic cylinder and a revolving wiper, of a receiver located adjacent thereto and provided with a projecting bottom and backwardly-turned lip or flange, substantially as and for the purpose described.

2. The combination with a chute, as A, the electromagnetic roll B, and the wiper-shaft



C, of the receiver D provided with the lip 28 at the edge thereof adjacent to said roll, substantially as described.

3. The electromagnetic roll B having the  
5 core *b* carrying the helix *c*, and wings 2, rigidly connecting said core with the shell thereof and provided with the heads 5 carrying the

trunnions 8, disks 3 and packing 4 being interposed between said heads and the ends of the helix, substantially as set forth.

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Witnesses:

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